WHAT IS CLAIMED IS

1. A device for measuring translation, rotation or velocity via light diffraction including a light source, at least one light detector, a first grating or a first grating and a fourth grating of the same spatial period and located substantially in a same first plane, and a second grating or a second grating and a third grating of the same spatial period and located substantially in a same second plane; the second and, where appropriate, third gratings being mobile along a given direction of displacement relative to the first and, where appropriate, fourth gratings, this device being arranged so that a first light beam generated by said source defined a beam incident upon said first grating where this incident beam is diffracted into at least a second beam and a third beam; so that these second and third beams then reach at least partially said second grating or said second and third gratings respectively, where they are respectively diffracted into at least fourth and fifth beams whose propagating directions are interchanged respectively with the propagating directions of said second and third beams; so that these fourth and fifth beams then reach at least partially said first grating or, when appropriate, said fourth grating where they are respectively diffracted in a same output diffraction direction so that they interfere at least partially, said light detector being arranged to detect at least partially light resulting from said interference; wherein said first and second gratings and, where appropriate, said third and/or fourth gratings are used in reflexion.

2. The device of claim 1, wherein said first and, where appropriate, fourth gratings belong to a portion of the device which is mobile relative to said incident beam, said second and, where appropriate, third gratings being fixed relative to this incident beam.

3. The device of claim 2, wherein said second grating and, where appropriate, said third grating are arranged between said source and said detector.

4. The device of claim 3, wherein said second and, where appropriate, third gratings form together with said source and said detector a measuring head of this device, said first grating defining a scale of said device.

5. The device of claim 4, wherein said detector is integrated in a region of a semiconductor substrate bearing said second grating and, where appropriate, said third grating.

6. The device of claim 4 or 5, wherein said light source is integrated or arranged in a region of a semiconductor substrate bearing said second and, where appropriate, said third grating.

7. The device of claim 1, wherein the second and, where appropriate, third gratings have a spatial period which is twice as small as that of the first and, where appropriate, fourth gratings, said second and third beams being diffracted respectively into the « +1 » and « -1 » orders, said fourth and fifth beams being diffracted respectively into the « -1 » and « +1 » orders, and these fourth and fifth beams being respectively diffracted into the « +1 » and « -1 » orders in said same output diffraction direction by said first or, where appropriate, fourth grating.

8. The device of claim 2, wherein the second and, where appropriate, third gratings have a spatial period which is twice as small as that of the first and, where appropriate, fourth gratings, said second and third beams being diffracted respectively into the « +1 » and « -1 » orders, said fourth and fifth beams being diffracted respectively into the « -1 » and « +1 » orders, and these fourth and fifth beams being respectively diffracted into the « +1 » and « -1 » orders in said same output diffraction direction by said first or, where appropriate, fourth grating.

9. The device of claim 7, wherein said output diffraction direction defines an angle, in a plane perpendicular to lines forming the gratings, which has a value substantially equal to the angle of incidence of the incident beam multiplied by « -1 » relatively to an axis perpendicular to said gratings, only light interfering along this output diffraction direction being used for measuring a relative displacement.

10. The device of claim 8, wherein said output diffraction direction defines an angle, in a plane perpendicular to lines forming the gratings, which has a value substantially equal to the angle of incidence of the incident beam multiplied by « -1 » relatively to an axis perpendicular to said gratings, only light interfering along this output diffraction direction being used for measuring a relative displacement.

11. The device of claim 9 or 10, wherein the light from said incident beam forming said second, third, fourth and fifth beams and finally detected by the detector reaches said first grating at an angle of incidence which is not zero in a plane perpendicular to lines forming the gratings, this angle of incidence being sufficient so that the source providing said light and the detection region of the detector receiving said light are spatially separated from each other in projection in a plane perpendicular to said lines.

12. The device of claim 7 or 8, wherein a diffraction region of said first or fourth grating, from which originates said light resulting from said interference and detected by the light detector, is arranged so that other interference, along different diffraction directions to said first direction and originating from different diffraction orders of said fourth and fifth beams than respectively « +1 » and « -1 », have at least one of the two contributions of these fourth and fifth beams whose amplitude is

considerably less than the amplitudes of the fourth and fifth beams diffracted along said first diffraction direction in said diffraction region.

13. The device of claim 7 or 8, wherein said first grating is arranged, in a region of said first grating receiving the light from said first beam finally detected by said detector, so that the « 0 » diffraction order is relatively low, said first beam being diffracted in this region mostly into said « +1 » and « -1 » orders.

14. The device of claim 1 or 7, wherein said first grating and, where appropriate, said fourth grating are formed in a dielectric layer of index n greater than 1.8, so as to achieve a larger diffraction efficiency with shallower grating grooves.

15. The device of claim 1 or 7, wherein said second grating and, where appropriate, said third grating are formed in a dielectric layer on top of a reflective substrate, so as to achieve a large diffraction efficiency for the TE polarization.

16. The device of claim 1 or 7, wherein said first and second gratings, where appropriate said third and/or fourth gratings are each formed of several longitudinal secondary gratings of close but different frequencies allowing an absolute displacement measurement over at least one range of measurement.

17. The device of claim 1 or 7, wherein it further includes at least one diffraction grating of increasing and/or decreasing period, arranged beside at least one of said first and second gratings, where appropriate said third and fourth gratings so as to define at least one reference position for said detector or for another detector provided for this purpose.

18. The device of claim 1 or 7, wherein it further includes at least one diffraction grating having at least one offset or phase jump in the arrangement of its lines so as to define at least one reference position for said detector or for another detector provided for this purpose.

19. The device of claim 1 or 7, wherein it is arranged for measuring the relative velocity between said first and second gratings, the sole measurement of the frequency of the detected luminous intensity modulation providing said relative velocity.

20. The device of claim 1 or 7, wherein at least one grating among said first and second gratings, and where appropriate said third and fourth gratings has a region where its lines are offset or phase shifted relative to the rest of this grating or is formed of at least two secondary gratings of the same period and of phase shifted or offset lines between these secondary gratings, this phase shift or offset being provided so that said light resulting from said interference has two partial beams or two distinct beams whose alternating luminous intensity signals, which varies as a function of the relative position between a first portion attached to said source and a

second mobile portion relative to said first portion, are phase shifted, in particular by Π/2, to allow detection of the relative displacement direction between these first and second portions and interpolation in an electric period of the luminous intensity signals.

21. The device of claim 4, wherein said light source is formed of an electroluminescent diode.

22. The device of claim 21, wherein it includes an optical collimation element arranged between said source and said first grating.

23. The device of claim 1 or 7, wherein said source emits light forming a first partial beam incident upon said first grating at a positive angle of incidence and another partial beam incident upon said first grating at a negative angle of incidence, said first and second gratings, and where appropriate, said third and fourth gratings, being provided on either side of the two regions of incidence of said first and second partial beams incident upon said first grating so as to form on either side said first to fourth beams and to generate on either side said interference between said fourth and fifth diffracted beams, the light resulting from this interference being detected on either side by at least two detectors also arranged on either said of said regions of incidence.

24. The device of claims 7 or 8, wherein said source emits light forming a first partial beam incident upon said first grating at a positive angle of incidence and another partial beam incident upon said first grating at a negative angle of incidence, said first and second gratings, and where appropriate, said third and fourth gratings, being provided on either side of the two regions of incidence of said first and second partial beams incident upon said first grating so as to form on either side said first to fourth beams and to generate on either side said interference between said fourth and fifth diffracted beams, the light resulting from this interference being detected on either side by at least two detectors also arranged on either said of said regions of incidence.

25. The device of claim 23, wherein said source is attached to said second and, where appropriate, third gratings of which useful portions situated on either side of said source are offset or phase shifted relative to each other so that the alternating light signals resulting from said interference and detected respectively by the two detectors are phase shifted, in particular by Π/2, in relation to each other.

26. The device of claim 23, wherein it further includes a fifth diffraction grating arranged between said source and said first grating, this fifth grating diffracting mostly into the « +1 » and « -1 » orders respectively on either side of a direction perpendicular to said first grating.

27. The device of claim 26, wherein said source provides a substantially collimated beam propagating along a direction substantially perpendicular to said first grating.

28. The device of claim 1 or 7, wherein at least said first or second grating defines a bi-directional diffraction grating of the same spatial period along said two orthogonal axes.

29. The device of claim 1, wherein it includes at least first and second reflective surfaces, the first reflective surface being arranged to deviate said first beam, originating from said source and propagating substantially along said displacement direction, in the direction of said first grating in order to provide said incident beam, said second reflective surface being arranged to reflect said light interfering along said output diffraction direction in a direction substantially parallel to said displacement direction before being received by said detector.

30. The device of claim 29, wherein said source and said detector are attached to said first and, where appropriate, fourth gratings and said first and second reflective surfaces being formed on a rod supporting said second and, where appropriate, third gratings.